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ABSTRACT

This course guide for a wood technology course is one of four developed for the production area in the North Dakota senior high industrial arts education program. (Eight other guides are available for two other areas of Industrial Arts--energy/power and graphic communications.) Part 1 provides such introductory information as a definition and instructional objectives for Industrial Arts. Part 2 contains the course rationale and objectives; guidelines for implementation; taxonometric structure; course description including length, credit, prerequisites, and student competencies; suggested instructional units with required number of class periods; and eight units. Each unit includes some or all of the following material: unit objective(s), topic outline, and selected student competencies to be developed through sample coordinated learning activities. Unit titles are Standardized Materials of Wood Technology, Safety and Accident Prevention, Processes, Design of Wood Products, Cabinet Construction, Wood Preservation, Career Opportunities in the Wood Industry, and Tool Maintenance. A reference list is appended. (YLB)

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NORTH DAKOTA SENIOR HIGH
INDUSTRIAL ARTS
CURRICULUM GUIDES

WOOD TECHNOLOGY

(PRODUCTION)

INDUSTRIAL ARTS
SENIOR HIGH--LEVEL II

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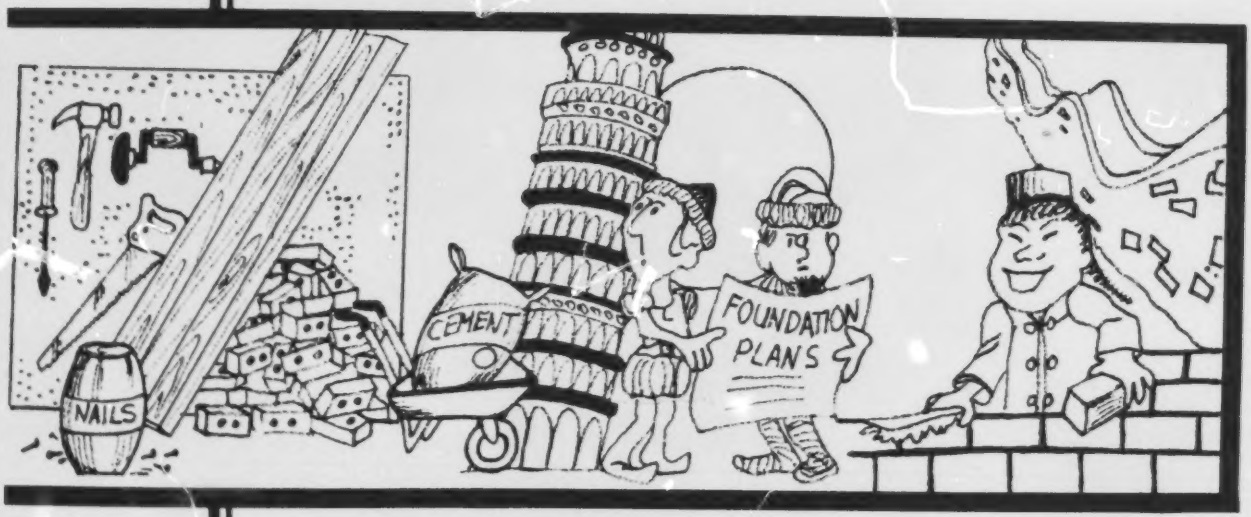

NORTH DAKOTA

NORTH DAKOTA STATE BOARD FOR
VOCATIONAL EDUCATION
Bismarck, North Dakota

CE030566

NORTH DAKOTA SENIOR HIGH INDUSTRIAL ARTS CURRICULUM GUIDES

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PREFACE

One of the biggest challenges facing education today is keeping the instructional content current. Industrial Arts in particular must be quick to respond to changes in our technological society. For many years, North Dakota has offered quality industrial arts programs to students in the public schools. Credit for this is due to the teachers who have shown the desire to continually improve programs, keep their content current, and make instruction relevant.

The Industrial Arts curriculum has boundless potential for courses and program development. However, this program possibility excites the imagination of teachers to offer endless number of courses which causes a need to determine what is of greatest value for students to experience.

Thus, the development of an appropriate or model curriculum requires a critical examination of several undergirding questions: What is the overall responsibility of Industrial Arts? What Industrial Arts goals are appropriate for the different grades or school levels? What courses constitute a meaningful curriculum for these goals to be realized? What shall be the scope and sequence of the total curriculum? The answers to these questions have been addressed by a North Dakota Industrial Arts Master Plan curriculum committee and are recorded in the North Dakota Senior High Industrial Arts Program of Studies booklet.

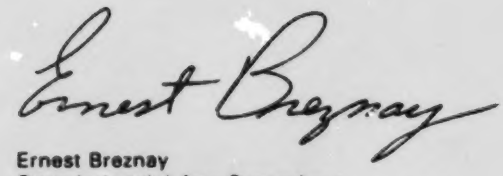
The Program of Studies describes the complete secondary school industrial arts education. The Program of Studies Booklet emphasizes the Level II Senior High programs with specific courses, course descriptions, objectives and units of instruction. The Junior High-Level I program is dealt with in a general basis for the purpose of articulating the two levels within the total secondary school industrial arts program.

Three types of Industrial Arts programs are included in the Program of Studies along with the individual courses which constitute the complete secondary school curriculum:

1. ORIENTATION AND EXPLORATION-- Level I program designed for grades seven through nine. The purpose of this program is to provide students with first-hand exploratory experiences in the four technical cluster areas. The learning experiences should provide an awareness of the impact of industry and it's associated technologies on the lives of individuals. Furthermore, this program assists individuals in making informed and meaningful occupational/career choices.
2. PERSONAL ENRICHMENT-- The program designed to prepare students with a general education of technolgical literacy, avocational skills and consumer information. This is purely an elective program of students for students who desire to gain an understanding of the technical concepts for personal satisfaction.
3. PRE-TECHNICAL-- This program provides concentrated and specialized technical courses for grades ten through twelve. These courses are articulated with the Level I technical cluster areas. Students at this level have a wide range of interests, abilities, and life aspirations. Therefore, the key element for the senior high pre-technical program is flexibility to meet the varied needs of learners. The program is designed to prepare students for advanced educational or training programs.

The North Dakota Senior High Program of Studies identified twelve different courses recommended to be offered in grades ten, eleven and twelve. The model curriculum lists four courses for each of three technical areas: (1) Energy/power,(2) Graphic Communications, and (3) Production. Individual course guides have been developed for each of the twelve courses recommended for the senior high curriculum. This being one of the twelve course guides. Similar guides have been developed for the remaining eleven.

Each course guide contains the course rationale, objectives,content, units and selected student competencies to be developed along with student learning activities. The primary aim of the course guides is to provide meaningful direction and still leave opportunity for individual teacher creative approaches in meeting the diverse needs of unique school populations. The course guides not only proposes to assist teachers and administrators in keeping their programs up-to-date, but also to promote industrial arts education program uniformity among North Dakota schools.



Ernest Breznay
State Industrial Arts Supervisor
North Dakota State Board for Vocational Education
July, 1981

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The North Dakota Industrial Arts profession is indebted to the following individuals who gave their time and talents in the development of the Twelve Senior High Industrial Arts course guides. These teachers and teacher educators attended an Organizational meeting, participated in a curriculum writing seminar, and developed individual course guides during 1980 & 1981.

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TABLE OF CONTENTS

Page

PART I: INTRODUCTION

-PREFACE ii
-ACKNOWLEDGEMENTS iv
-BASIC BELIEFS ABOUT INDUSTRIAL ARTS 1
-THE INDUSTRIAL ARTS MISSION & GOALS 2
-INSTRUCTIONAL OBJECTIVES 3
-NORTH DAKOTA INDUSTRIAL ARTS 4
-THE PROGRAM OF STUDIES 5
-PROGRAM STANDARDS 6
-COURSE CODE NUMBERS 7

PART II: WOOD TECHNOLOGY COURSE GUIDE (# 10023)

-RATIONALE & OBJECTIVES 9
-GUIDELINES FOR IMPLEMENTATION 10
-TAXONMETRIC STRUCTURE 17
-COURSE DESCRIPTION & SPECIFICATION 18
-SUGGESTED INSTRUCTIONAL UNITS 19
-INDIVIDUAL UNIT SPECIFICATIONS 20
(Unit Objectives, Content Outline, Selected Student Competencies & Sample Learning Activities):

UNIT #

I. Standardized Materials of Wood Technology 20
II. Safety & Accident Prevention 28
III. Processes 30
IV. Design of Wood Products 33
V. Cabinet Construction 35
VI. Wood Preservation 37
VII. Career Opportunities in the Wood Industry 39
VIII. Tool Maintenance 41

-REFERENCES 43

BASIC BELIEFS ABOUT INDUSTRIAL ARTS

INDUSTRIAL ARTS IS .....

- an educational discipline founded upon the knowledge base of technology - the means by which material things are produced.
- an instructional program affording boundless opportunities for learning how technology has been, is now and will be basic to human desires and needs.
- a fundamental educational program that can serve educational priorities, whether they are academic education, general education, vocational education, career education, ad. inf.
- an activity based curriculum enabling students to learn through doing.
- logically a discipline with a curriculum continuum grade K through 12.

INDUSTRIAL ARTS IS JUSTIFIED BECAUSE .....

- all persons need to know about the technological environment, the material culture, and industry because they are economically, socially and emotionally affected by them.
- all persons must make a career choice from an extremely large and increasing number of occupations that are affected by technology; therefore, they should have opportunities to develop interests, uncover talents, explore technical and applied science fields and study occupations.
- all persons must select, buy, use, and maintain the products of industry -- houses, automobiles, appliances, clothes, furniture and items of a never ending list. A knowledge of products, their manufacture, characteristics, advantages and disadvantages makes for intelligent consumption.
- all persons need recreational, leisure time and avocational outlets.
- all persons need to have opportunities to develop planning, creative, problem solving and technical skills in harmony with their inherent desire to seek the better way.

INDUSTRIAL ARTS CAN HELP THE STUDENT TO .....

- gain an understanding of industry and technology.
- discover interests and talents.
- develop techniques in problem solving.
- develop basic skills in the safe use of tools and machines.
- make informed and meaningful occupational choices.
- acquire interests in avocational pursuits and hobbies.
- develop safe working habits.
- apply other school subjects.
- become a wiser consumer.
- develop creativity.
- develop pride in work well done.
- work cooperatively with others.

THE INDUSTRIAL ARTS MISSION

The mission of Industrial Arts Education is to assist the student in developing an understanding about industry and technology and in the discovery and development of individual potential.

GOALS

Consistent with their abilities, interests and educational needs:

1. Industrial Arts students at the middle or junior high school level will be aware of employment and/or self-employment opportunities and requirements for use in making career choices and in determining their educational programs.

2. Industrial Arts students at the senior high school level will acquire technical competencies in preparation for advanced vocational or technical education programs.

3. Industrial Arts students at the senior high school level will acquire competencies that lead to responsible citizenship through technological understanding, consumer knowledge and the productive use of leisure time.

INDUSTRIAL ARTS: AN OFFICIAL DEFINITION

Industrial Arts education programs means those education programs which pertain to the body of related subject matter, or related courses, organized for the development of understanding about the technical, consumer, occupational, recreational, organizational, managerial, social, historical, and cultural aspects of industry and technology including learning experiences involving activities such as experimenting, designing, constructing, evaluating, and using tools, machines, materials, and processes which provide opportunities for creativity and problem solving or assist individuals in the making of informed and meaningful occupational choices or which prepare them for entry into advanced trade and industrial or technical education programs.

INDUSTRIAL ARTS INSTRUCTIONAL OBJECTIVES

Industrial Arts students at the Senior High School Level will acquire competencies that lead to responsible citizenship through technological understanding, consumer knowledge and the productive use of leisure time. The program stresses the following instructional objectives:

1. Develop an insight and understanding of industry and technology, its place in our society and the free enterprise system.
2. Discover and develop individual talents, aptitudes, interests, and potentials as related to industry and technology.
3. Develop an understanding of industrial processes and the practical application of scientific principles.
4. Develop technical problem-solving and creative abilities involving the use of materials, processes, and products of industry and technology.
5. Develop an understanding of industrial and technological career opportunities and their requirements and develop those traits which will help students obtain and maintain employment.

As determined by Title II of PL No. 94-482, the Vocational Education Act of 1976 and the State Board for Vocational Education, the purpose of funding industrial arts programs with vocational monies will be to:

1. Assist individuals in the making of informed and meaningful occupational and educational choices.
2. Prepare individuals for enrollment in advanced or highly skilled vocational and technical programs.

NORTH DAKOTA INDUSTRIAL ARTS CURRICULUM

Program Scope and Sequence Model

ELEMENTARY LEVEL
(k-6)
Awareness

At the elementary level, learning experiences in industrial arts will be directed primarily toward the child's development of an awareness of industry/technology and the world of work. The concepts and activities will be integrated with the elementary curriculum to enrich and reinforce the common learning areas.

JUNIOR HIGH LEVEL I
(7-9)
Orientation and Exploration

INSIGHTS INTO INDUSTRY & TECHNOLOGY

A broad overview of industry and technology. Learning experiences will be directed toward the student's exploration of the historical, present, and future potentials of industry and technology.

- GRAPHIC COMMUNICATIONS TECHNOLOGY
- MANUFACTURING TECHNOLOGY
- CONSTRUCTION TECHNOLOGY
- ENERGY/POWER TECHNOLOGY

SENIOR HIGH LEVEL II
(10-12)
Personal Enrichment
Pre-Technical

- DESIGN/DRAFTING
  PHOTOGRAPHY
  GRAPHIC ARTS
  CONSTRUCTION DRAFTING
  INDIVIDUAL TECHNICAL PROBLEMS
- PRODUCTION
  WOOD TECHNOLOGY
  PLASTIC TECHNOLOGY
  METAL TECHNOLOGY
  INDUSTRIAL CRAFTS
  INDIVIDUAL TECHNICAL PROBLEMS
- ENERGY SOURCES
  POWER TECHNOLOGY
  ELECTRICAL / ELECTRONIC TECHNOLOGY
  TRANSPORTATION TECHNOLOGY
  INDIVIDUAL TECHNICAL PROBLEMS

THE INDUSTRIAL ARTS PROGRAM OF STUDIES

LEVEL	GOAL	PROGRAM
II HIGH SCHOOL (Grades 10, 11, & 12)	1. Personal Enrichment 2. Pre-Technical	GRAPHIC COMMUNICATIONS TECHNOLOGY •Design/Drafting •Photography •Graphic Arts •Construction Drafting •Industrial Technical Problems ENERGY/POWER TECHNOLOGY •Energy Sources •Power Technology •Electrical/Electronic Technology •Transportation Technology •Individual Technical Problems PRODUCTION TECHNOLOGY •Wood Technology •Metal Technology •Plastic Technology •Industrial Crafts •Individual Technical Problems INDIVIDUAL TECHNICAL PROBLEMS (Multiple Offerings)
I JUNIOR HIGH SCHOOL (Grades 7, 8, &9)	1. Orientation 2. Exploration	•Insights into Industry and Technology •Graphic Communications Technology •Manufacturing Technology •Construction Technology •Energy/Power Technology

PROGRAM STANDARDS FOR INDUSTRIAL ARTS

ELEMENTS OF QUALITY INDUSTRIAL ARTS PROGRAMS

The success and quality of programs in industrial arts education depends upon elements that influence the quality of programs. Industrial arts must be responsive to the following elements:

A. GOALS AND OBJECTIVES: Program goals and objectives are established that provide the inspiration and guidance in program development, operation and evaluation.

B. INSTRUCTIONAL STAFF: The instructional staff is competent and meet necessary qualifications.

C. INSTRUCTIONAL PLAN: Selected subject matter is appropriate to learner's level and consistent with curriculum and course goals and objectives.

D. STUDENT ORGANIZATIONS: The establishment and operation of effective student organizations.

E. FACILITIES AND EQUIPMENT: Instructional facilities are well-designed, located and supportive of accomplishing curricular goals. (Refer to Educational Specifications for Industrial Arts Instructional Facilities Handbook, 1978.)

F. SPECIAL NEEDS: The program must provide for disadvantaged and handicapped students.

G. ADVISORY COMMITTEES: The establishment and effective use of industrial arts advisory committees.

H. GUIDANCE: The teacher's role in guidance.

I. ADMINISTRATION: Administration of the industrial arts program.

J. EVALUATION: Evaluation procedures are planned and implemented to assure continual program improvement.

NOTE: For further information on program standards, refer to the NORTH DAKOTA VOCATIONAL/TECHNICAL EDUCATION PROGRAM STANDARDS, Section 11.1 to 11.7.

INDUSTRIAL ARTS COURSE CODE NUMBERS
(Vocationally Funded)

Insights Into Industry and Technology	10001
Construction Technology	10011
Manufacturing Technology	10021
Wood Technology	10023
Metal Technology	10026
Plastic Technology	10029
Energy and Power Technology	10031
Electrical/Electronic Technology	10033
Energy Sources	10038
Power Technology	10039
Graphic Communications Technology	10051
Graphic Arts	10052
Design/Drafting	10053
Photography	10054
Construction Drafting	10056
Transportation	10061
Industrial Crafts	10080
Individual Technical Problems	10091
Individual Technical Problems	10092

PART II:

WOOD TECHNOLOGY COURSE GUIDE

(# 10023)

WOOD TECHNOLOGY

Rationale:

Because of the importance of industrial arts as a subject at the senior high school level with certain basic assumptions, be it resolved that, it is worthwhile for all students to understand and manage their industrial technology environment. The study of production technology in its broadest sense, is a study of the technology as it relates to other technologies and education in the overall school curriculum. The production technology is a body of knowledge organized in such a way that it aids students in the making of informed and meaningful future choices. Moreover, the production technology consists of instruction in woods, plastics, metals, and industrial crafts industries. These instructional areas are considered as courses with numerous major units of study to permit the students to see the importance of industrial arts in relationship to their place and goals in our industrialized society.

Course Objectives:

1. To provide students with an opportunity to study wood, wood technology, processes in fabricating, manufacturing and constructing wood products having design, material selection, fabrication techniques, and utility consistant with the wood producing industry.

2. To provide students with the major segments of the production industry producing wood products so that they may make informed future career choices.

3. To provide students with the technology of producing wood and wood products to better understand the relationships which exist across various disciplines with that of the applied production technology.

Guidelines For Implementation

Success in the classroom or laboratory depends on many factors. Foremost among these is the planning effort on the part of the teacher. Educational programs must be flexible and adaptable. They must be flexible enough to remain adaptable to all locales, in numerous types of facilities, and with students possessing differing values and interest. Therefore, a successful program must be capable of application in both small and large schools.

The industrial arts program recommended by these course guides are designed to meet individual student needs. They provide teachers with guidelines for a well balanced program with suggested teacher options in each of the three major technical study areas: (1) Graphic Communications; (2) Energy/Power; and (3) Production. The North Dakota secondary school industrial arts program suggests three levels of learning with an alternative curriculum approach at the Level II for those schools that cannot offer specific courses identified for each of the three technical study areas due to the size of enrollments or other limiting factors.

Production Technical Area Guidelines

The recommended scope and sequence of course offerings for the production technical study area is illustrated on the sample program model on page 13. The Level I courses (Manufacturing Technology and Construction Technology) are recommended as prerequisites for the production courses listed at Level II. The senior high Level II courses provide concentrated and indepth exploratory experiences in four production courses: (1) Wood Technology; (2) Metal Technology; (3) Plastic Technology; and (4) Industrial Crafts. Since students at the high school level display a wide range of interests, abilities, and life goals, the industrial arts program must provide a variety of learning experiences and options to meet individual needs. To meet the varied student needs, it is recommended that the specific courses be made available to students when possible. For the smaller and mid-sized schools, it may not be feasible to offer all four of the specific production courses identified for Level II. If that should be the case, it is recommended that one or two of the courses be offered and an ITP (Individual Technical Problems) course be offered as a Level II alternative. (See ITP Course specifications on page 14.) This course is designed to provide multiple experiences in production to meet individual needs.

The Level III ITP course (Code #10093) is suggested for students in larger programs who have had the Level II indepth exploratory courses in the production area and desire to study a specialized aspect related to industrial materials, production processes, and/or production organization. (See pages 15 and 16 for specific Level III ITP Course specifications and study options).

Guidelines For Implementing the Wood Technology Course

1. Identify personnel who aid in curriculum change, development and implementation.

2. Identify and gain support of administration, civic & parent organizations.

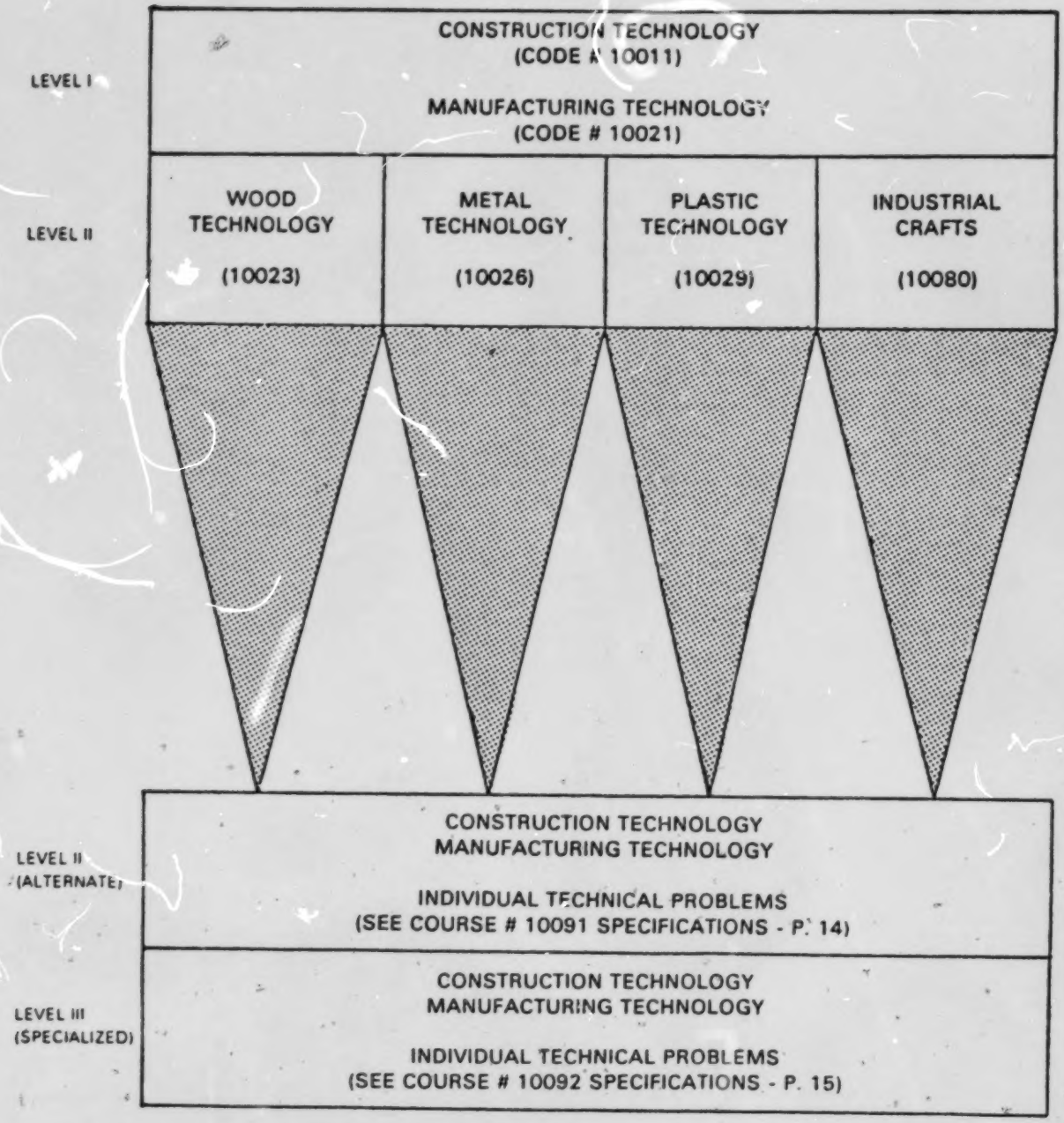
3. Arrange for a detailed presentation of the program to key personnel.

4. School systems should make the program universal throughout all high schools, if two or more.

5. Arrangements should be made for the purchase of software, hardware & laboratory materials.

6. Arrangements should be made for inservice preparation of all teachers of the construction technology program.

7. Scheduling of instructional units may be adjusted to accommodate students and the instructional year.



Sample Program Model

INDIVIDUAL TECHNICAL PROBLEMS

COURSE CODE: 10091

This individual technical problem course is designed for students who have not had the opportunity to enroll in specific Level II subject matter courses in the Production Technology cluster area. The course is designed to provide a means for meeting individual student needs through the offering of multiple activities in a number of technical areas in schools where separate courses are not available.

INDUSTRIAL ARTS PURPOSE

Personal Enrichment

Pre-Technical

GRADE LEVEL

11 - 12

COURSE LENGTH

One period per day

18 or 36 weeks

UNIT OF CREDIT

½ or 1 unit

RECOMMENDED PREREQUISITES

Level I Curriculum Courses

SELECTED STUDENT COMPETENCIES

NOTE: Individual student competencies and learning experiences are to be identified and developed on a contractual basis by the student and approved by the instructor for each problem.

SAMPLE LEARNING TOPICS

NOTE: Learning topics for the ITP are to be selected from the instructional units identified for each specific subject matter course. These courses include:

PRODUCTION TECHNOLOGY:

-- Wood Technology, 10023
-- Metal Technology, 10026
-- Plastic Technology, 10029
-- Industrial Crafts, 10080

INDIVIDUAL TECHNICAL PROBLEMS: PRODUCTION

COURSE CODE: 10092

This individual technical problem course is designed for students who have had the Level II preliminary course of this cluster in the chosen area of study and intend to study specific information and techniques in wood, plastic, metal technology courses and/or industrial crafts.

INDUSTRIAL ARTS PURPOSE

Personal Enrichment

Pre-Technical

GRADE LEVEL

11 - 12

COURSE LENGTH

One period per day

18 or 36 weeks

UNIT OF CREDIT

½ or 1 unit

RECOMMENDED PREREQUISITES

Level I Curriculum Courses and Level II

Instruction in this industrial arts course is open to meet student needs. The following suggested objectives are meant to provide ideas for developing students programs.

1. To prepare students for seeking advanced education in the area of production.
2. To provide students the experiences in problem-solving, research and development with regard to any specific topic in production courses.
3. To provide students with information regarding industrial materials, processes and the practical applications of scientific principles.
4. To provide students with an understanding of industry, it's place in society, and the free enterprise system.
5. To provide students with an understanding in related career opportunities in production.

10092
COURSE CODE

INDIVIDUAL TECHNICAL PROBLEMS:

PRODUCTION

SAMPLE LEARNING UNITS

WOOD TECHNOLOGY:

I. Anatomical Structure of Wood
II. Forest Ecology
III. Physical Nature of Wood
IV. Wood Defects
V. Lamination Processes
VI. Peg Diffusion
VII. Wood Plastic Composition
VIII. Residential Construction
  A. Sub-structure
  B. Super-structure
IX. Commercial Construction
X. Wood By-Products
XI. Product Design
XII. Product Finishing
XIII. Preservation Materials
XIV. Occupations - Present and Future
XV. Safety Development
XVI. Prototype Construction
XVII. Bending Fixtures

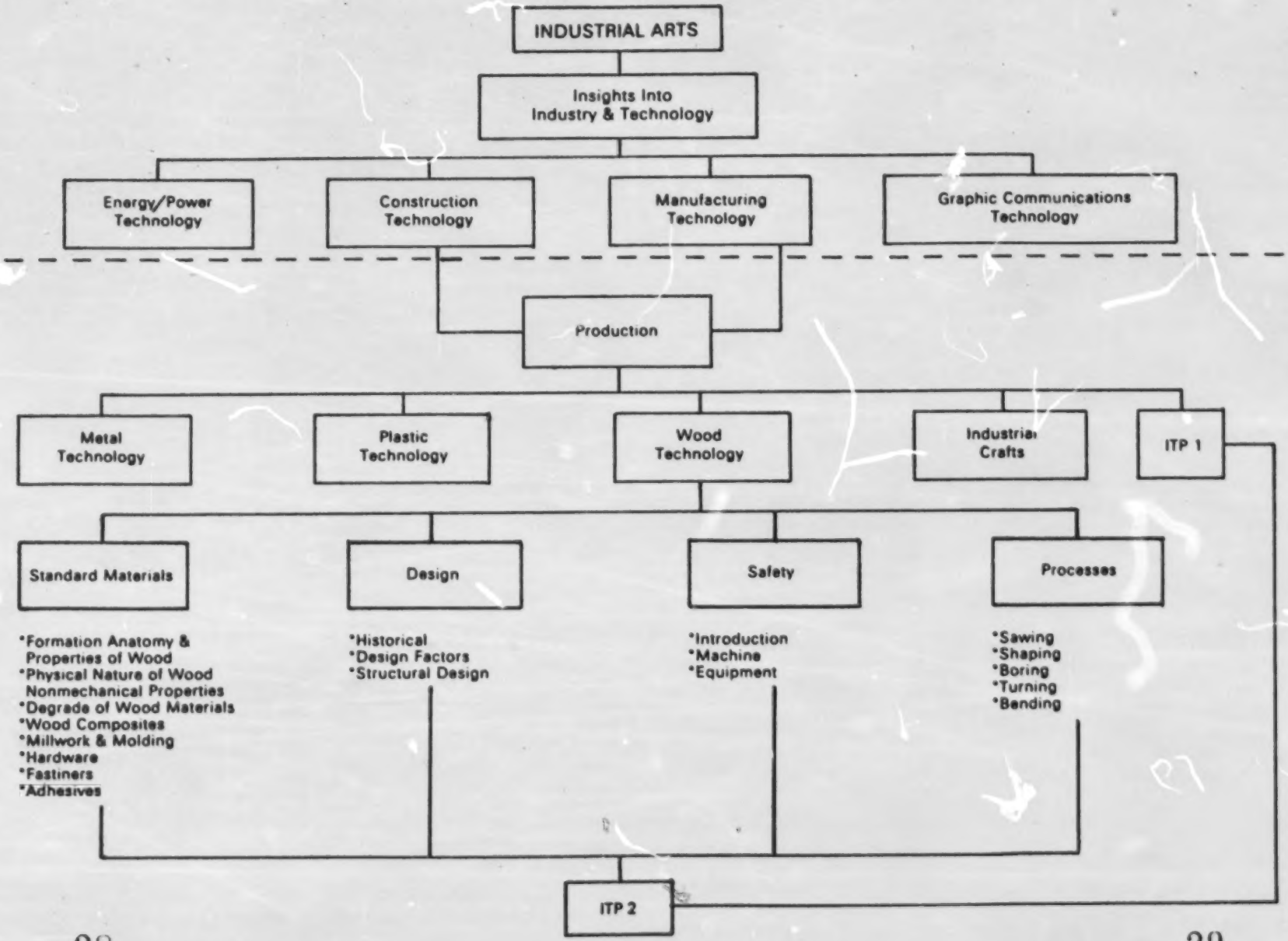
METAL TECHNOLOGY:

I. EDM
II. Chemical Milling
III. Explosive Forming
IV. Adhesives
V. Investment Casting
VI. Forging
VII. Heat Treatment of Metals
VIII. Metal Turning
IX. Extrusion Processes
X. Powder Metallurgy
XI. Multi-Related Problems
XII. Automation
XIII. Accident Prevention Study

PLASTIC TECHNOLOGY:

I. Mold Construction
  A. Expandable Bead Molds
  B. Liquid Plastic Molding
  C. Vacuum Forming Molds and Rotational
II. Decorating and Finishing Applications of Plastic
  A. Advertising
  B. Natural Finishes

III. Study Developments of Future Applications of Plastic
IV. Uses of and Choices of Bonding Agents
V. Plastic Products
   A. Production of Plastic Products
   B. Study of Industrial Processes
VI Study of Optical Properties
VII. Plastic Products
VIII. Safety and Health Hazards of Toxic Fumes From Plastic Materials


INDUSTRIAL ARTS
Insights Into Industry & Technology
LEVEL I
Energy/Power Technology
Construction Technology
Manufacturing Technology
Graphic Communications Technology
Production
LEVEL II
Metal Technology
Plastic Technology
Wood Technology
Industrial Crafts
ITP 1
Standard Materials
Design
Safety
Processes
*Formation Anatomy & Properties of Wood
*Physical Nature of Wood Nonmechanical Properties
*Degrade of Wood Materials
*Wood Composites
*Millwork & Molding
*Hardware
*Fastiners
*Adhesives
*Historical
*Design Factors
*Structural Design
*Introduction
*Machine
*Equipment
*Sawing
*Shaping
*Boring
*Turning
*Bending
ITP 2

WOOD TECHNOLOGY

COURSE CODE: 10023

Students design, plan and build furniture, recreational, or other wood products using machine tools, processes and wood technology. Creativity should be emphasized as students further develop their interests, talents, and abilities in production of wood products.

INDUSTRIAL ARTS PURPOSE

Personal Enrichment

Pre-Technical

GRADE LEVEL

10 - 12

COURSE LENGTH

One period per day

18 or 36 weeks

UNIT OF CREDIT

½ or 1 unit

RECOMMENDED PREREQUISITES

Level I Manufacturing Curriculum

Course 10021 and Wood Technology, 10023

SELECTED STUDENT COMPETENCIES

Experiences and activities of this industrial arts course will enable the student to:

1. Compare and evaluate the various characteristics of good design used in the production of furniture, cabinets, and other wood products.
2. Solve simulated industrial design or planning problems in the production of a product.
3. Discuss critically how designing and planning relate to the fabrication of furniture and cabinets in various types of industrial production.
4. Solve problems related to commercial types and applications of finishes.
5. Devise, compare and estimate the specific industrial experience, applications or operations necessary for the production in quantity of a particular product made of wood or a related forestry product.
6. Evaluate the application of wood technology in the fabrication of industrial products.
7. Evaluate the quality of finishing materials.
8. To determine and solve technical problems relating to wood technology.
9. Use safe work habits and to promote safety consciousness.

10023
Course Code

WOOD TECHNOLOGY

Suggested Instructional Units

		Class Periods (18 wks)	(36 wks)
I.	Standardized Materials of Wood Technology	4	10
II.	Safety & Accident Prevention	2	3
III.	Processes	25	60
IV.	Design of Wood Products	2	10
V.	Cabinet Construction	50	75
VI.	Wood Preservation	3	10
VII.	Career Opportunities in the Wood Industry	2	[illegible]
VIII.	Tool Maintenance	2	[illegible]
	TOTAL	90	180

UNIT I

Standardized Materials of Wood Technology

OBJECTIVES:

This unit is meant to provide the student with:

1. An understanding of wood and the industry.
2. A knowledge of the structure of wood, physical nature of wood and degrade of wood due to growth and seasoning.
3. The recognition of features of wood of value in identification, its characteristics and properties.

1.0.0 Standard Materials of Wood Technology

2.0.0 The Wood Industries of America

- 2.1.0 Historical development
- 2.2.0 Major forest areas
- 2.3.0 Wood products today
- 2.4.0 Wood in industry

3.0.0 The Formation, Anatomy, and Properties of Wood

- 3.1.0 Properties common to all woods
- 3.2.0 Properties of certain species
- 3.3.0 Variability in species
- 3.4.0 Wood as industrial raw material
- 3.5.0 Wood as a construction and manufacturing material

4.0.0 Gross Structure of Wood

- 4.1.0 Types of plants producting wood
  - 4.1.1 Characteristics of woody plant
  - 4.1.2 Kinds of woody plants
- 4.2.0 Plant classification (field identification)
  - 4.2.1 Characteristics of hardwoods
- 4.3.0 Factor controlling the designation of a wood as commercially important

4.4.0 Tree growth

4.4.1 Annual growth increment

4.4.1.1 Early and late growth
4.4.1.2 Sapwood and heartwood

4.4.2 Formation of the cell wall

4.4.2.1 Primary cell wall development
4.4.2.2 Secondary cell wall development

4.4.3 The structure of softwoods

4.4.3.1 Radial alignment of cells
4.4.3.2 Resin canals present or absent
4.4.3.3 Split tangential surface dimpled or not dimpled
4.4.3.4 Heartwood with or without a distinct odor
4.4.3.5 Pleasantly fragrant or ill-scented
4.4.3.6 Heartwood distinct or not distinct

4.4.4 The structure of hardwoods

4.4.4.1 Non-radial alignment of cells
4.4.4.2 Vessel (Pores) elements
4.4.4.3 Complex structure
4.4.4.4 Rays prominent & variable in width
4.4.4.5 Early-wood pores conspicuous
4.4.4.6 Transition gradual or abrupt
4.4.4.7 Broad rays present of absent
4.4.4.8 Early-wood pores ring porous, semi-porous or diffuse

5.0.0 Physical Nature of Wood

5.1.0 Moisture content in wood

5.2.0 Dimensional changes in wood

5.3.0 Specific gravity & density of wood

5.4.0 Thermal properties of wood

5.5.0 Electrical properties of wood

5.6.0 Permeability of wood

5.7.0 Acoustical properties of wood

6.0.0 Growth Related Defects in Wood

6.1.0 Types of cross grain

6.2.0 Knots

6.3.0 Growth stresses

6.4.0 Reaction wood

6.5.0 Brashness

6.6.0 Frost injuries

6.7.0 Pitch defects

6.8.0 Bark pockets

7.0.0 Defects Due to Seasoning

7.1.0 Seasoning defects

7.2.0 How wood dries

7.3.0 Checks

7.4.0 Checked & loose knots

7.5.0 Warping

7.6.0 Casehardening

7.7.0 Reverse caseharding

7.8.0 Collapse

7.9.0 Honeycombing

7.10.0 Ring failures

7.11.0 Box-heart splits

8.0.0 Defects Due to Machining

8.1.0 Raised grain

8.2.0 Chipped & torn grain

8.3.0 Machine burn

8.4.0 Loosened grain

8.5.0 Fuzzy grain

9.0.0 Wood Composites

UNIT I

9.1.0 The veneer, plywood & laminating industries

9.2.0 Veneer classification

9.3.0 Hardwood & softwood plywood grades

9.4.0 Wood composition-board industry

10.0.0 Millwork and Moldings

10.1.0 History of millwork

10.2.0 Survey of occupations

10.3.0 Educational requirements for cabinetmaking

10.4.0 Millwork products

10.5.0 Molded products

11.0.0 Fastners

11.1.0 Introduction to hardware

11.2.0 Kinds of standardized fastners

12.0.0 Hardware

12.1.0 Introduction to hardware

12.2.0 Kinds of standardized hardware

13.0.0 Adhesives

13.1.0 Kinds of gluing

13.2.0 Kinds of adhesives

13.3.0 Clamping devices

13.4.0 Gluing procedures and problems

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Wood Technology

UNIT I: Standardized Materials of Wood Technology

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Contrast the wood industries of America in terms of historical development, major forest areas, wood products of today and wood in industry.	A.1 Read and discuss the development of the industry, sighting major forest areas viewing wood products of today and observe the kinds of wood used in the products.
B. Differentiate the properties common to all and specific to some wood species recognizing the variability in species as industrial raw materials used in construction and/or manufacturing.	B.1 Read and discuss the properties common to all species, properties specific to some and compare sample wood species as to their variability, suggesting why some species are utilized in construction and/or manufacturing.
C. Differentiate the gross structural features of hardwoods and softwoods; their types, characteristics, and factors designating wood as industrial material.	C.1 Discuss, show, and identify gross features of wood that enable the student to see, smell, or touch those characteristics which lead to classification, kind and factors leading to the selection of wood as an industrial material.
D. Differentiate and compare characteristics of tree growth i.e., annual growth rings, early and late wood, sapwood vs. heart-wood, cell formation and structure and characteristics leading to identification of species.	D.1 Read, discuss, and analyze selected wood species looking for distinguishing characteristics and properties that lead to fulfilling the competencies, in the factors of tree growth and species identification.

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Wood Technology

UNIT I: Standardized Materials of Wood Technology

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
E. Compare and contrast the physical nature of wood in terms of; moisture content, dimensional changes, specific gravity, thermal, electrical, permeability, and acoustical properties that lead to informed choices about its use and application.	E.1 Given, or by conducting tests, the student should compare and contrast the various aspects of the physical nature of wood. Tests may be conducted on determining the moisture content by weight loss or electrical conductance meter; measure radial, tangential, and longitudinal dimensions due to moisture loss or gain; perform specific gravity, electrical, thermal, permeability, and acoustical tests according to need, level and availabilities of various apparatus available as described in the instructional resources.
F. Identify several defects in wood that lead to degrade due to growth; these defects may be knots, pitch pockets, bark pockets, injury due to external forces, reaction wood, growth stresses and types of cross grain.	F.1 List several observed defects found in wood and sketch these observations so as to recognize those growth defects that lead to degrade and application of these grades to construction and manufacture of wood products.

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Wood Technology

UNIT I: Standardized Materials of Wood Technology

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
G. Discuss and demonstrate the defects found in wood as a result of air and kiln-drying of wood. These defects by name are; checks, warp, case-hardening, collapse, honey-combing, and etc.	G.1 List several observed defects found in wood; and conduct tests for casehard-ening (found in the textbook of Wood Technology) to determine and solve the problems resulting from the reasoning of wood.
H. Discuss and identify defects found in wood due to machining These defects may be; raised grain, chipped, or torn grain, fuzzy grain, loosened grain, machine burn, and etc.	H.1 Select and identify on several pieces of wood defects which arise when improper machining of wood takes place. List several possible solutions to correct the sources of defects being created.
I. Discuss and observe the many wood composites now used in the industry. These compo-sites are; veneer, plywood, lumber-core plywood, particle board, and high/low density fiberboard. Given samples of each, the student should be able to identify and differ-entiate between these materials and their qualities leading to usage.	I.1 Identify and differentiate each of the various wood composites. Write specifi-cations with regard to standard sizes, grades and kinds of materials and their application.
J. Discuss the history of millwork, current and future occupations, educational requirements, products produced, and methods of producing molded wood products.	J.1 Identify current and future career requirements, products produced and methods of molding wood products. Students may perform tasks in producing moldings using routers, shapers and other suitable tools and machines.

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Wood Technology

UNIT I: Standardized Materials of Wood Technology

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
K. Differentiate among a variety of mechanical fasteners, standard mechanical fastners, and choose those most appropriate for given applications.	K.1 Identify and list a variety of mechanical fasteners and write the specifications for those most often used.
L. Compare and contrast the design, function, style and application of hardware, such as, drawer pulls, door pulls, guides and glides with appropriate applications.	L.1 List the various kinds of hardware in terms of their design, function, style and their appropriate applications.
M. Select appropriate chemical fastners (synthetic adhesives) on the bases of their kinds, characteristic and performance in given applications. Demonstrate the use of appropriate clamping devices, their adjustment gluing procedures and solutions to possible gluing problems.	M.1 Identify and compare adhesives and clamping devices. Solve pressure problems such that appropriate pressures are applied. Solve gluing and clamping problems to the extent that demonstrates competencies in avoiding problems in future use of chemical fastners.

UNIT II

Safety & Accident Prevention

OBJECTIVES:

This unit is meant to provide the student with:

1. Proper techniques in use of machines & tools.
2. A sense of care for safety in self, others, materials, equipment and competency in maintaining and caring for equipment and facilities.
3. The attitude of proper judgement to plan ahead to avoid accidents.

1.0.0 Safety & Accident Prevention

1.1.0 Introduction

1.1.1 Safety concepts: dress, courtesy, housekeeping, planning, lifting, unsafe behavior, hair, chemical, dust, hand tools

1.2.0 Machine safety

1.2.1 Portable tools, stationary machines

1.3.0 Safety equipment

1.3.1 Eye protection, fire equipment, ladders & scaffolding, guards

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Wood Technology

UNIT II: Safety & Accident Prevention

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. List the safety concepts of dress, courtesy, hair, housekeeping, planning, dust, lifting, unsafe behavior, dust, chemical and hand tools.	A.1 Discuss and demonstrate each concept and explain possible danger signs to students, e.g., lifting with back instead of legs or lifting in poor position, and danger of loose clothing or jewelry getting caught in moving parts.
B. The student will perform operations on machines and portable tools used in course.	B.1 Explain parts and safety procedures for each power tool and machine that will be used in course.
C. Make a list of all available safety equipment in work area.	C.1 Show the location of all safety equipment and the proper usage of each.

UNIT III

Processes

OBJECTIVES:

This unit is meant to provide the student with:

1. Information concerning sawing, shaping, boring, turning, and etc.
2. An understanding of bending and laminating procedures.

1.0.0 Processes: Hand and Machine Tools

- 1.1.0 Principle of separating
  - 1.1.1 Shearing
  - 1.1.2 Sawing
- 1.2.0 Principle of shaping
  - 1.2.1 Gauges and files
  - 1.2.2 Routers and shapers
- 1.3.0 Principle of boring
  - 1.3.1 Hand drills, push drills, braces
  - 1.3.2 Portable drills, drillpress
- 1.4.0 Principle of turning
  - 1.4.1 Spindle
  - 1.4.2 Faceplate
- 1.5.0 Principle of bending
  - 1.5.1 Lamination
  - 1.5.2 Steaming or soaking
  - 1.5.3 Kerfing

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Wood Technology

UNIT III: Processes

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Differentiate between shearing and sawing operations. Safely operate various saws in work area.	A.1 (1) Show film on shearing and sawing operations. (2) Show examples of shearing, (veneer). (3) Cut curves on jig saw, band saw or with portable saw. (4) Cross cut samples on radial arm, table saw, and with portable circular saw. (5) Do ripping operation on table saw, radial arm saw, band saw and portable circular saw. (6) Saw various angles on radial arm, and table saw. (7) Read and discuss principles of shearing and sawing operations.
B. Recognize routed and shaped designs on manufactured items. Safely operate router and shaper.	B.1 (1) Read and discuss principles of shaping. (2) Use hand tools to make samples of shaped edge. (3) Set up router and cut variety of edges and designs in portable operation. (4) Set up shaper and show diferent adjustments to produce various designed edges.
C. Understand use of hand drill, push drill, and brace in proper job locations. Safely operate portable drill. Identify operations suitable to drill-press.	C.1 (1) Read and discuss principles of drilling and boring. (2) Use hand drill, push drill and brace to drill small holes. (3) Use portable drill to drill small holes.

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Wood Technology

UNIT III: Processes

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
	(4) Set up operation on drillpress for large piece and for small piece showing proper clamping methods.
D. Distinguish between spindle and faceplate operations. Be able to set up various turning operations. Correctly use inside and outside calipers.	D.1 (1) Discuss, principle of turning. (2) Turn sample of spindle turning, e.g., mallet handle and head. (3) Turn sample of faceplate turning, e.g., bowl. (4) Demonstrate proper use of inside and outside calipers.
E. Distinguish laminated articles and understand process by which they were made. Recognize bend articles from steam soaking method as compared to articles sawed to shape. Understand bending by use of the kerfing method.	E.1 (1) Discuss principles of laminating. (2) Demonstrate use of jigs for laminating. (3) Show film. (4) Discuss and demonstrate methods of steaming and soaking. (5) Use of jigs for binding.

UNIT IV

Design of Wood Products

OBJECTIVES:

This unit is meant to provide the student with:

1. The ability to distinguish and recognize styles and good design.

2. The ability to identify and define elements, steps, and principles of design.

1.0.0 Design of Wood Products

- 1.1.0 Historical
  - 1.1.1 Period furniture
  - 1.1.2 Traditional design
- 1.2.0 Design factors
  - 1.2.1 Principle of design
  - 1.2.2 Ornamentation
  - 1.2.3 Decorative environment
  - 1.2.4 Effects of color
  - 1.2.5 Upholstery
- 1.3.0 Structural design
  - 1.3.1 Selecting construction methods
  - 1.3.2 Joint selection
  - 1.3.3 Making and reading plans
  - 1.3.4 Determining wood costs

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Wood Technology

UNIT IV: Design of Wood Products

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Distinguish furniture by its design and be able to tell its time period in history including period furniture to traditional design.	A.1 Discuss history of furniture. Write a paper on various periods. Visit furniture showroom at stores. Compare difficulty of various designs from builder's view.
B. Understand principles of design. Recognize ornamentation features. Compare effects of color. Use upholstery in proper locations.	B.1 List principles of good design. Compare various types of ornamentation. Make samples of various colors on various woods. Upholster small item or make drafting showing upholstery procedure.
C. Differentiate between strength of different designs. Identify types of joints. Be able to read plans determine costs.	C.1 Make a list of different structural designs and rate from strongest to weakest. Make list of various joints with diagrams of each. Draft plan for a product. Make a bill of material for drafted product or from other drafting.

UNIT V

Cabinet Construction

OBJECTIVES:

This unit is meant to provide the student with:

1. The ability to identify various types of cabinet construction.
2. The ability to identify and construct various basic wood joints, and evaluate their holding power.

1.0.0 Cabinet Construction

- 1.1.0 Joinery
- 1.2.0 Frame and panel
- 1.3.0 Leg and rail
- 1.4.0 Cabinet and furniture door
- 1.5.0 Drawers and guides
- 1.6.0 Cabinet interiors
- 1.7.0 Leg and post
- 1.8.0 Table and cabinet tops

SELECTED STUDENT COMPETENCIES AND SAMPLE LEARNING ACTIVITIES FOR

Wood Technology

UNIT V: Cabinet Construction

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Distinguish between the various common joints.	A.1 List and diagram the various joints. Construct the joints.
B. Understand their proper use and location and know their holding powers.	B.1 Fasten the joints differently and test their strength.

UNIT VI

Wood Preservation

OBJECTIVES:

This unit is meant to provide the student with:

1. The ability to choose the proper preservative for various locations and applications.
2. Knowledge of equipment used in application of preservatives.

1.0.0 Wood Preservation

- 1.1.0 Surface preparation
- 1.2.0 Base coat
- 1.3.0 Top coat

2.0.0 Application

- 2.1.0 Brushing
- 2.2.0 Rolling
- 2.3.0 Pads
- 2.4.0 Spraying
- 2.5.0 Dipping

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Wood Technology

UNIT VI: Wood Preservation

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Understand proper surface preparation. Understand proper preservative for various locations. Know difference between base coat and final coat.	A.1 Prepare several woods for finish. Apply base coat to each. Apply final coat to each. Use several finishes and test pieces under different conditions such as, (wet-heat-wear).
B. Be able to use various equipment for application of finishes. Understand the be best method for location being finished. Clean equipment properly.	B.1 Apply finish with a brush, clean brush. Apply finish with a roller, clean roller and pan. Apply finish with a pad, clean pad. Apply finish with a spray gun, clean gun. Apply finish by dipping.

UNIT VII

Career Opportunities in the Wood Industry

OBJECTIVES:

This unit is meant to provide the student with:

1. An understanding of various careers from lumbering of forest products through finishing of a complete job.

1.0.0 Career Opportunities

1.1.0 Survey of occupations and careers

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Wood Technology

UNIT VII: Career Opportunities in the Wood Industry

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Be aware of the wide range of careers from: the growing of lumber, to the harvesting of lumber, to producing building materials, to the making of furniture and the construction of buildings.	A.1 Construct a list of career opportunities using magazines, papers, books, films, and state agencies as resource materials.

UNIT VIII

Tool Maintenance

OBJECTIVES:

This unit is meant to provide the student with:

1. An appreciation of properly conditioned tools.
2. The ability to care for and recondition tools.

1.0.0 Tool Maintenance

- 1.1.0 Reconditioning of hand tools
- 1.2.0 Care of machines

SELECTED STUDENT COMPETENCIES
AND SAMPLE LEARNING ACTIVITIES
FOR

Wood Technology

UNIT VIII: Tool Maintenance

SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
THE LEARNING ACTIVITIES SHOULD ENABLE THE STUDENT TO:	
A. Appreciate well cared for tools and be able to recondition various tools used in woodworking.	A.1 Sharpen hand tools brought from home such as, chisels, planes, saws, gauges, screwdrivers, etc. Sharpen machine blades.
B. Be able to use manuals to service machines.	B.1 Service a machine using the manual for that machine.

REFERENCES

Recommended Text for High School:

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